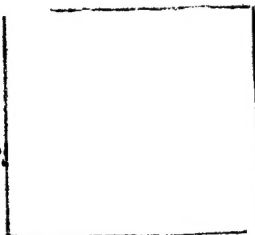


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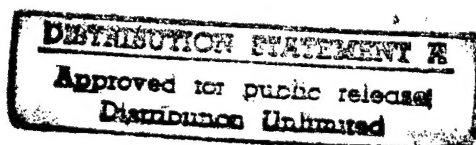
SCIENTIFIC CONFERENCE ON THE PROBLEM OF SPACE PERCEPTION AND

ILLUSIONS OF SPACE, 20-23 MAY 1959

- USSR -

by B. F. Lomov

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FOREWORD

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SCIENTIFIC CONFERENCE ON THE PROBLEM OF SPACE
PERCEPTION AND ILLUSIONS OF SPACE,
20-23 May 1959

Following is a translation of an article by B. F. Lomov
in Voprosy Psikhologii (Problems of Psychology), No. 6,
Moscow, November-December 1959, pages 182-186.

A scientific conference on the problem of space perception and illusions of space, organized by the Leningrad section of the Society of Psychologists of the APN [Academy of Pedagogical Sciences] RSFSR, took place from 20 to 23 May, 1959. Representatives of the various branches of psychology, physiology, ophthalmology, descriptive geometry, structural design, methods of teaching mathematics, and certain other scientific disciplines, participated in the work of this conference.

In opening the conference, the chairman of the Leningrad section of the Society of Psychologists, B. G. Anan'yev, stated that three tasks stand before the conference: 1), the union of specialists of various sciences for the complex problem of space perception and illusions of space; 2), discussion of experimental data on the problem of the reflection of space; 3), raising of applied problems in order to solve the problems practically in the field of production, education, sports, medicine, and art.

Seven reports were heard in the first session. In the report of B. G. Anan'yev (Leningrad) "The System Mechanism of Space Perception and the Twin Work of the Large Hemispheres of the Brain," he developed the thought that space-discrimination functions are peculiar to all analyzers of the external and internal environment of man's organism. Space perception has as its base the inter-action of the analyzers, the relationship between which changes depending upon the space peculiarities of the objects of perception. However, under any conditions, a basic functional system is preserved -- visual - vestibule - kinesthetic associations. Analyzers with twin receptors play a special role in the system mechanism of space perception.

The report of E. Sh. Ayrapet'yants and V. A. Bianka (Leningrad) "Material in the Evolution of Twin Activity of the Brain" was devoted to the problem of the physiological mechanisms of the interaction of symmetric sections of the brain of various groups of animals.

In the experiments conducted by conditional reflexes it was made apparent that in all the investigated animals (fish, tortoise, rabbit, dog, and monkey) the symmetric sections of the brain worked as a single whole functional system. Destruction of the link between these sections through surgery results in a deterioration of space analysis. The symmetric centers bring about both joint, as well as separate activity. Normal functioning of both the external and internal analyzers depends upon the joint work of the symmetrical sections of the brain.

P. O. Makarov (Leningrad) reported on the space-time relationships (chronotop) in the activity of the analyzers of man. The lecturer pointed out the dependence of the visual darkness adaptation, the absolute threshold of excitability, "discreteness" of the visual analyzer on the space-time relationships of adequate stimuli, and also showed the dynamics of these relationships in the act of adaptation to darkness, in the evolution of excitement and the sensation of their functional mobility.

A. N. Dobromyslov (Kishinev) in his report "Electroencephalograph Indexes of Binocular Vision and Its Violations" disclosed the peculiarities of the twin operation of the gray visual centers of people who possess and do not possess binocular vision. At the basis of binocular vision lies the gray matter dynamics stereotype, whose conditional links join the twin vision receptors into a single functional system. When binocularity is lost, this stereotype, despite its stability, is replaced in time by the stereotype of non-binocular sight. The peculiarities of one or another stereotypes is clearly detected in an EEG /electroencephalogram/. The lecturer cited data concerning the remodeling of the gray matter stereotypes in the cure of strabismus and in the treatment of binocular vision.

The report of E. Sh. Ayrapet'yants (Leningrad) "The Problem of Functional Structure of a Space Analyzer" was devoted to the problem of the role of various analyzers and their inter-action in space orientation of animals (mammals, birds, and fish). Experiments have shown that a definite complex of analyzers participates in the analysis and synthesis of space factors. The degree of participation of each analyzer in this complex depends upon the phylogenetic and ecological criteria, as well as on the tasks of the organism which are closest to concrete circumstances.

The connecting link in the complex is the motor analyzer. Thanks to the special role of the latter in gray matter integration the function of representative species is brought about when both the distant receptors, as well as the vestibule analyzer, is shut off.

The lecturer put forth the conception of the "space analyzer," which is one of the important sides of the integrative activity of the cortex of the brain and is an unfailing participant of any act of the upper nervous activity.

In the report of N. A. Tukh (Leningrad) "The Reflection of Space Relationships and Reason" the idea is developed that the origin and development of the reason of man is directly tied up with the development of the forms of reflection of space-geometric, space-static, space-dynamic, and space-time relationships.

A. V. Yarmolenko (Leningrad) in his report "The Role of Speech in the Reflection of Space" put forth the results of a comparative analysis of the names of the space coordinates in various languages, testifying to the fact that space illusions and concepts are formed by people depending on the system of language designations of space coordinates in the life of a given people and on the conditions of this life.

In the second session, the majority of reports was devoted to the problem of the participation and role of the movements of receptors (chiefly the eyes).

B. Kh. Gurevich (Leningrad) gave a report on "The Conditional Reflector Base of the Visual Perception of Space." The investigation, using the method of electro-ocular science, disclosed the formation and role of proprioception in fixation reflexes. An analysis of the motor make-up of the conditional reflectors of the eyes in darkness showed that the time links of the effector centers ensures only coarse outlines of these reactions, which in detail are controlled by kinesthetic "return communications." Return communications, acting on the course of the reaction, guides and corrects it depending on the fractional information signals from proprioceptors and error signals. The generalized experience of the eye-motor reflector activity plays an important role in space orientation, participating in the formation of object-space illusions.

The method of electro-ocular science was also used in the research of L. I. Leushinaya and E. P. Kok (Leningrad), who studied the role of the movement of the eyes in the process of differentiating distance and size of objects in a plane. It would seem that in the process of differentiation, the movements of the eyes precede the evaluation of an irritant, and that there is a definite deflection angle of the eyes corresponding to each differentiated distance or size of the irritant, and a turn of the eyes to an angle which does not correspond to the irritant precedes an incorrect evaluation. Elimination of the movements of the eyes results in deterioration of the differentiation of the difference in size. When differentiation is strengthened, it is possible to evaluate the irritant without a preceding movement of the eye. Experiments testify to the necessary participation of afferent signals in space vision.

V. D. Glezer (Leningrad) in his report "The Role of Convergence in Depth Vision" showed the importance of the proprioceptive signals for stereoscopic vision. Experiments showed the high degree of correlation between the thresholds of convergence and the thresholds of stereoscopic vision. But for the foveal vision the thresholds of convergence were 30-50 times more than the stereo thresholds. Therefore,

convergence cannot take part in stereo vision when the angular divisions of the object are small. The probability of convergence arising is greater the more divided the objects are in depth. In the case where there is convergence, its role in stereoscopic vision is equal to the role of disparateness of the images on the retina.

In the report of V. Ya. Dymerskiy (Moscow) "The Problem of the Active Nature of Perception of the Distance of Moving Objects" the results were shown of the investigation of the perception of movement, effected on the basis of the reflection of space-time relationships. Thus, the speed of movement is perceived on the basis of the relationship of irritants due to the angular speed of the movement of the objects in relation to the eye of the observer, as well as the direction and distance of the object. Under determined conditions the distance of the object and its measurements can be evaluated by evaluating the visible speed of the object and the changes in this speed. The relationship of space and time components of perception, and the nature of its activity is determined by the peculiarities of the concrete activity of the subject, its object, conditions and tasks.

P. A. Sorokun (Pskov) gave a report on the theme "The Influence of Illusions on the Space Position of Visual Consecutive Forms When the Eyes are Closed." Experimental data testifies to the fact that the space position of consecutive objects (caused both voluntarily and involuntarily) is due to reflector reactions of the motor apparatus of the visual analyzer, which arises in answer to action of various irritants. The inter-action between the first and the second signal systems plays an essential role in the voluntary change of the positions of consecutive forms.

The report of V. P. Zinchenko (Moscow) and B. F. Lomov (Leningrad) "The Comparative Analysis of the Movement of the Hand and Eye in the Process of Tactile and Visual Perception" was devoted to the problem of the role of the movements of receptor apparatus in perception (the report will be printed in an issue of the magazine in the near future).

In the report of N. I. Krylova (Moscow) the results were shown of the investigation of the functional role of the movement of the eyes in synthesizing visual irritants subsequently appearing. The comparison of the time that it takes to learn by heart and the nature of the process of memorization of subsequently appearing signals, either in the presence or absence of eye movements, makes it possible to consider that kinesthetic impulses contribute to the formation of simultaneous grouping (simul'tannaya gruppirovka).

N. A. Tukh made a report on "The Problem of the Genesis of Perception of Form." The data from the experiments on people and animals indicated that the reflection of various experiments of a given form play a varied role in the formation of the whole form. Any new object causes the necessity, in the developed process of perception, of ascertaining whether this concerns vision or tactile knowledge. When perceptions are repeated, there arises the possibility of orienting oneself only to certain "strong" components of the figure, its "signal points."

The report of R. A. Kharitonov (Leningrad) "Methods of Investigating Space Discernment With the Fingers of the Hand," heard in the third session, was devoted to the problem of the space-discerning function of the tactile analyzer. Experiments, conducted with the help of an instrument constructed by the lecturer, made it possible to reveal certain peculiarities in the development of functional asymmetry of the hands. They showed the inter-communication of muscle-joint and tactile sensitivity in the discernment of distance.

Problems in the development of illusions of space of children were discussed in the third and fourth sessions.

A. N. Znamenskaya (Leningrad) gave two reports: "The Role of Analyzer Systems in the Development of Conditional Reflexes on Space Position of Objects of One Year-Old Children" and "The Role of the Signal Systems in the Formation of Signal Reflexes of Children From Two to Four Years Old to the Space Position of Objects."

The experiments showed that in one-year-old children the motor analyzer is the leading one in the development of the conditional reflexes on space position of objects. The fact that their participation is limited makes it impossible to form these reflexes. The accommodation mechanism plays an important, but not the main role in them.

A guiding importance of the motor analyzer in the formation of conditional reflexes to the position of an object was shown in children from two to four years old. Verbal signals play a secondary role at this age.

V. K. Kotyrlo (Kiev) threw light on the problem "Mastery of the Dimensions of Objects by Children of Pre-School Age." According to the lecturer, the process of the tactile knowledge of the dimensions of objects by pre-school children rests on the development of their ability to differentiate, abstract, and theorize on the various space signs of the object. The mastery of dimension is perfected in connection with the development of a general space orientation. As the experience of graphic-effective discernment of dimension accumulates, the children gradually come to distinguish dimensions by means of mental efforts. The word plays an essential role in this process.

M. V. Vovchik-Blakitnaya (Kiev) gave a lecture on "The Discernment of Pre-School Children of the Space Relationships Between Objects." The ability to discern the space relationships goes through a number of successive stages, caused by changes in the problems of life which arise as their activity increases. The first stage is characterized by a graphic orientation of the child in space. In the second stage, the verbal designation of distinguishing space signs becomes accessible to him. However, the tactile knowledge of space does not go beyond the limits of the practical discernment of relationships, which are brought about only from the position of the child itself in space. More generalized ideas about space are characteristic of the third stage. Here there is the opportunity of determining the position of objects not only in relation to the child himself, but in relation to other objects.

The report of T. A. Museyibovaya (Leningrad) was also devoted to the problem of "The Development of Understanding Space Relationships and Their Reflection in the Speech of Pre-School Children." In the report, an analysis was given of the basic stages of the process of mastering terms which designate space relationships, and the role of the teacher in this process was also shown.

B. A. Sazont'yev (Petrozavodsk) in the report "The Problem of the Genesis of the Perception of Space and Space Illusions" discussed his experience in teaching pre-school children the method of a realistic perspective image of three-dimensional objects. Special organization of the perception of space, utilized in this training experiment, made it possible for the investigators to overcome the errors characteristic in the pictures of children, and to show them how to imagine volume.

The problems of the development of illusions of space of school children were discussed in the following cycles of reports.

Yu. M. Mukhin (Pskov) reported on "The Target-Directed Perception of Proportion by Students in the First Grade When Drawing from Nature," and indicated the role of the efficient method in forming imagery. The central link of such a method is the organization of target-directed perception of nature and the continual comparison of proportions in a picture, with the proportions in nature.

O. I. Galkina gave a report on the development of space illusions of children in elementary school. The chief criteria which characterized the development of these illusions are: the level of their speech symbols; the level of the synthesis of the space and quantitative illusions; the level of the inclusion of space illusions in mental processes. In the development of space illusions of the students, there were three stages. The first stage is based on the development of their discernment and recognition of space symbols and relationships. The second is tied up with the development of their ability to reproduce these signs and relationships in an illusion. The transfer of the students to elements of space relationships (*kombinatorika*) (in their imagination) was characteristic of the third stage.

E. P. Tonkonogaya (Leningrad) spoke on "The Peculiarities of Differentiation and the Synthesis of Space Illusions by Children in the Fourth Grade." Mastery of the practice of building a plan passes through a series of stages. For the beginning stage, it is characteristic to include in the plan elements of a painting and lack of differentiation of space relationships in the drawing. The following stage is characterized by an exact differentiation of only one of the space relationships (either of direction or of distance). In the third stage, the students learn to correctly imagine both direction and distance. The synthesis of space in quantitative illusions plays an important role in the development of skill.

In the report of V. I. Zykova (Moscow) "Perception of Space Relationships by Students in the Sixth Grade in Measuring Work in A Locality" she discussed the problem of training the students in ways of surveying a plan. The experiments showed that mastery of the discernment of direction in the meaning of "tops" of a section (both clockwise and counter clockwise), raises the students to that level of analysis and theory of space relationships which ensures an exact and swift orientation in the relative position of all "tops" and side of a section.

The report of E. E. Shuleshko (Moscow) on "The Influence of the Method of Analysis of a Volumetric Form of Figures on the Nature of Their Grouping" was devoted to the problem of the influence of the activity of the students with volumetric forms on visual perception. The results of the research indicated that classification of figures is essentially determined by the methods of analyzing their volumetric form.

Reports on problems of the role and development of various forms of the reflection of space in labor and sport activity were heard in the last two sessions.

In the report of A. Ts. Tun' (Leningrad) it was shown that the kinesthetic space discernment is the basis for a complete mastery of the technique of physical exercises, and the very fine control of their movements by sportsmen. It is a link in the acts, tied up with the visual-motor coordination of movements and the so-called specialized perception of sportsmen (and "the feeling of time," "feeling of distance," "the feeling of water," etc.).

The problem of the development and role of space illusions in sports was also clarified in the report of E. N. Surkov (Leningrad) "The Dynamics of Space Symbols of Movement in the Forming of An Image of Gymnastic Exercises."

V. E. Bushurov (Leningrad) made a report on "The Interaction of Space, Force, and Time Components of the Movement of the Worker When the Habit of Filing Metal is Mastered." By utilizing the method of disconnecting and making the activity of various analyzers difficult, she showed their role in the control of the dimension, direction, tempo, speed and force of workers' movements.

In the report of B. A. Fedorishin (Leningrad) "The Role of Space Perception During the Work With Conveyors" he reviewed the problem of the dynamics of the development of the inter-relationship of the worker's space, sensory field and motor field in the process of labor by the workers of a sewing factory.

N. G. Levandovskiy (Leningrad) in his report "The Factors of Space and Time in the Problem of Handling the Panel of a Steam Kettle of an Electric Power Station" indicated the results of an analysis of the so-called dosage reactions.

The report of A. V. Skripichenko (Kiev) was devoted to the problem of individual differences in the perception of space.

A. F. Esaulov gave a report on the theme "The Development of Space Illusions in Creative Activity," in which he traced (by writings and drawings) the dynamics of the development of space illusions in the scientific and technical activity of K. E. Tsiolkovskiy.

F. N. Shemyakin (Moscow) spoke on "Perception and Illusion of the Shortest Distance on a Map and on a Globe." His experiments indicated that the evaluation of distance on a spherical surface, as the shortest possible distance, depends upon the relationship of the plane of the large circle and the plane of one's glance (the plane which passes through three points, two of which lie in the outer space and the third in the center of the "cyclopean eye").

The report of M. V. Gamezo (Moscow) and V. F. Rubakhin (Leningrad) "The Role of Space Illusion in the Study of a Topographic Map in the Decoding of Aerial Photographs" was devoted to an analysis of the process of mastering the practice of reading maps and deciphering aerial photographs. The research showed that this process is accompanied by a rebuilding of the structure of space images, as well as by change in the dynamics of their course in certain qualitative characteristics.

The report "The Psychology of Illusion of the Space Position of An Airplane in Flight" (E. A. Derevyanko, E. S. Zav'yalov, T. Kh. Gurvich, Moscow) was devoted to the problem of the role of space orientation to instruments in flight. The arising of illusions (a false bank, incorrect evaluation of the pitching angle, etc.) is tied up with the loss of the dominating role of the visual analyzers in the determination of the space position of the body of a man. Inasmuch as the vestibule, kinesthetic and tactile analyzers, in conditions whereby acceleration has an effect on them, lose the ability to give correct information on the position of the body of a flyer in space, then the domination of one of them can cause an illusion of the space position of an airplane. The basic way to fight illusions is to restore the dominating role of the visual analyzer.

E. L. Surin (Leningrad) in his report on the theme "The Role of Space Imagination in Design Work and in Teaching the Graphic Disciplines in the Higher Technical Schools" indicated that the space imagination and the blueprint being drawn in the process of design is in a dialectical unity. They complement and enrich each other. The lecturer emphasized the significance of graphic skills in the work of the designer.

The report of B. F. Lomov (Leningrad) "Certain Traits of the Dynamics of Form in the Process of Space Imagination" was devoted to the analysis of representations; that is, the process of voluntary, target-directed operation with forms, and mental activity with space. The successful solution of the problem on illusions depends upon the degree of stability and the details of the space illusions.

The experiments revealed certain traits of reaction of imaginative gestures, imaginative actions and speech in the process of representations (a short table of contents of these reports was published in the collection "Materials of the Conference on the Problem of Space Perception and Illusions of Space." L [Leningrad], 1959).

Approximately 30 men took part in the discussion of these reports.

In conclusion, the Chairman of the Leningrad Section of the Society of Psychologists, B. G. Anan'yev, noted the great productivity of the work of the Conference.

In the Conference, the desire was made known to carry out thematic conferences of a complex nature in the very near future.

It was decided to hold the following conference on the problems of the reflection of space and time in June of 1960.

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